



Analysis Of Occupational Health and Safety Risk in Mayang Madu City Housing Development on Jl. Raya Made in Lamongan

Aldin Saputro¹, Intan Mayasari², Putri Anggi Permata Suwandi³, Anggie Rama Guntara⁴

^{1,2} Prodi Teknik Sipil Universitas Islam Darul `ulum Lamongan, Jl. Airlangga No. 03, Sukodadi, Kabupaten Lamongan, Jawa Timur Indonesia, ³ Program Studi Teknik Sipil, Fakultas Teknik dan Informatika, Universitas PGRI Semarang Jl. Sidodadi Timur No. 24, Karangtempel, Semarang Timur District, Semarang City, Central Java 50232, ⁴ Department of Civil Engineering, Faculty of Science and Technology, University Islamic of Nahdlatul Ulama, No. 09 Taman Siswa Street, Pekeng, Tahunan, Jepara, 59427, Indonesia

Corresponding author: aldin1.2021@mhs.unisda.ac.id

Received 20 January 2026 ; Revised 19 Februari 2026; Accepted 31 March 2026 ; Published 1 May 2026

Abstract

This study aims to analyze the Occupational Health and Safety (OHS) risk factors that occurred in the Mayang Madu City Housing development project on Jl. Raya Made-Lamongan. The construction industry is a sector with a high risk of work accidents, so the implementation of an OHS management system is a crucial aspect in ensuring workforce safety. This study used a quantitative method with a survey approach. Data were collected through questionnaires distributed to 30 respondents consisting of project staff, field supervisors, and workers. Data analysis was conducted through validity and reliability tests, multiple linear regression, and risk mapping using a Cartesian diagram. The results showed that of the five main factors studied, only the work environment factor (X3) had a significant influence on the level of work accident risk. This factor includes the physical condition of the work area, weather, as well as evacuation access and warning signs. The Adjusted R Square value of 4.4% indicates that this research model is only able to explain a small portion of the variation in risk levels, so the results need to be interpreted carefully and considering the limitations of this study. The conclusion of this study is that work environment conditions have a dominant influence on the risk of workplace accidents in housing projects. Therefore, improving work area management, providing safety signs, and mitigating risks based on field conditions should be a top priority in implementing OHS in the construction sector.

Keywords: Occupational Health and Safety (K3), Work Accident Risk, Project Housing, Risk Management, Cartesian Diagram;

1. Introduction

Occupational safety and health (K3) is a crucial aspect in the construction industry, which aims to protect workers from various risks of accidents and occupational diseases. The construction sector is known as one of the industries with a high rate of workplace accidents due to the complexity of the work, the use of heavy equipment, and risky working conditions. Therefore, the implementation of an OHS program is crucial in every development project to create a safe, healthy, and productive work environment. However, despite its significant contribution, the construction sector also holds the potential for very high occupational safety and health risks. Various work activities involving the use of heavy equipment, working at heights, and dynamic field conditions make construction projects a challenging workplace from a safety perspective [1]. Housing construction projects have unique characteristics because they are a series of construction activities that take place in a relatively short time with limited resources to produce infrastructure that meets the standards specified in the contract documents [2].

 <http://dx.doi.org/xxxxx-XXXXXXXX>



© 2021 by the authors. Licensee Science and Technology, Indonesia. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC-BY) license (<http://creativecommons.org/licenses/by/4.0/>).

The budget and specifications planned in the contract documents may not necessarily align with what occurs during implementation. Therefore, during the construction implementation phase, service providers will be faced with various unforeseen conditions that constitute implementation risks [3]. One of the causes of disruption or cessation of project work is the risk of accidents that may occur in a construction project[4].

To eliminate or reduce accidents or losses that occur, a series of hazard identification and risk assessment activities are carried out using established risk management methods. After that, an assessment of the level of hazard risk is conducted and appropriate control measures are determined [5]. Risk management also involves analyzing, measuring, and determining the magnitude of risks, followed by identifying several alternatives to face or mitigate those risks[6]. However, occupational health and safety practices by construction service providers are often neglected, and only a limited number of stakeholders pay serious attention to this issue[4].

By implementing risk management, it is hoped that the project target of being free from work accidents that occur during the construction process will be achieved[1]. Based on the above background, it is necessary to conduct research on the analysis of Occupational Health and Safety (K3) Risks in the Two-Story Housing Development Project in Mayang Madu Madu City.

From these analyses, we can also predict the risks that will occur in the future. Based on the probability and impact of the risks that have occurred and other factors. Through this analysis, it is hoped that it will provide an overview of the importance of management and analyzing occupational health and safety risks quickly and accurately related to projects that will be carried out during the implementation of housing projects so as to reduce the negative impact of work accidents (cost overruns) in the implementation of the housing project. This research uses a quantitative research design with a case study method through a survey strategy using a questionnaire as a research instrument

1.1. Literature Review

1.1.1 Occupational Health and Safety (K3) Concept

Occupational Health and Safety (K3) is an integrated system designed to ensure protection for workers and all parties in the work environment from potential hazards that can cause accidents or health problems. K3 is an effort carried out systematically and continuously to ensure that workers remain in a safe condition, physically and mentally healthy, and protected from potential risks originating from the work environment[7].

Stated that the implementation of OHS not only covers the protection of workers' physical and physiological aspects, but also touches on psychosocial aspects that are influenced by working conditions, project pressures, and organizational culture[1]. International standards such as ISO 45001 and national regulations such as Government Regulation No. 50 of 2012 concerning OHS Management System (SMK3) provide a framework that can be adopted to strengthen the OHS system in every construction project. Implementing a good OHS system can prevent potential workplace accidents, reduce downtime due to incidents, and avoid additional costs arising from material and non-material losses.

Law No. 1 of 1970 concerning Occupational Safety, which emphasizes the obligation of employers to guarantee the safety of workers by providing protective equipment, training, and a safe work environment. Government Regulation No. 50 of 2012 concerning the Occupational Health and Safety Management System (SMK3), which regulates the implementation of a risk-based safety management system in the workplace. Minister of Manpower Regulation No. 5 of 2018 concerning Occupational Safety and Health in the Construction Environment, which establishes operational and technical standards for the implementation of K3 for all construction service business actors[2].

Factors Influencing the Implementation of K3 Project management commitment, which determines resource allocation and safety policies implemented. Worker awareness and attitudes, in terms of compliance with the use of PPE and safe work procedures [3]. Training and education, which play an important role in increasing the workforce's understanding and competence regarding potential risks in the workplace. Supervision system, which includes direct monitoring and sanctions for K3 violations.

This risk arises from the interaction between potential hazards and uncontrolled work activities. According to, occupational risk is the result of the relationship between the likelihood of a hazard occurring and the severity of its impact on workers and the work environment. Also states that risk in the context of OHS is a combination of the probability of a hazardous event occurring and the consequences of that event. Therefore, risk identification and evaluation are essential parts of an OHS management system to prevent workplace accidents

1.1.2 Housing

Housing is a collection of houses that function as a residential environment or residential environment equipped with environmental infrastructure and facilities as well as public facilities. Housing is part of regional development that has a strategic role in improving community welfare because it is directly related to basic human needs, namely habitable

and affordable housing. Housing is one of the basic components in urban planning that determines population distribution patterns, land use, and social and economic interactions of the community. It can be concluded that housing is a housing system that is integrated according to function[6].

2. Material and Methods

Validity testing is a test conducted to measure the extent to which the items in a questionnaire are able to measure the intended variable. In this study, validity testing will be conducted by analyzing the correlation between the score for each statement and the total score for the variable. This testing is conducted statistically using IBM Statistical Product and Service Solution (SPSS) version 26.

The reliability testing method used was the internal consistency method using the Cronbach's Alpha (alpha) reliability coefficient. Reliability testing was conducted on all questions simultaneously. Test results were considered reliable if the Cronbach's Alpha (alpha) value was > 0.6 .

In the context of this research, the coefficient test will look at the influence of independent variables (K3 risk factors) on the dependent variable (level of work accident risk). Used to map respondents' perceptions of the level of importance and performance of K3 implementation in the field, which is visualized through colored data points based on risk categories and factors.

This type of research is descriptive qualitative research, namely research that aims to provide a systematic, factual, and accurate picture of the facts on the ground related to the implementation of Occupational Safety and Health (K3) in the Mayang Madu City Housing development project. This approach was used because the problem being studied is of a multifaceted nature with aspects (Architecture) so that it can support a decent, healthy, and sustainable life for its residents. complex and requires an in-depth understanding of the behavior, processes, and K3 policies applied in the implementation of construction projects

A qualitative approach allows researchers to explore the meaning, understanding, and experiences of workers and project managers regarding the implementation of OHS. Using this approach, researchers can capture the social and contextual dynamics that occur in the field, including obstacles, strategies, and responses to implemented safety policies. This research is also exploratory in nature, meaning that there are not many studies that specifically discuss the implementation of OHS in local housing projects such as Mayang Madu City.

2.1. Data collection technique

Participatory Observation: Researchers conducted direct observations in the field to identify working conditions, application of PPE, implementation of safety procedures, and workers' attitudes towards K3. In-depth Interviews: Conducted with key informants, such as project managers, K3 officers, foremen, and field workers, using semi-structured interview guidelines. Questionnaire Study: Conducted to collect data from statements of an indicator and the data collection technique is via a Google Form questionnaire.

2.2. Data Analysis Technique

Validity Test: This test is conducted to determine the extent to which the questionnaire items are able to measure the intended variables. Validity testing is performed by examining the Corrected Item-Total Correlation value in the SPSS output. The criteria used are that a statement item is declared valid if the correlation value is greater than 0.30 and the significance value is < 0.05 .

Reliability Test: Reliability testing is used to determine the level of consistency of research instruments. This test is performed by calculating Cronbach's Alpha using SPSS. The instrument is declared reliable if the Cronbach's Alpha value ≥ 0.60 . Average Value Calculation: After the data is declared valid and reliable, the average value for each risk indicator is calculated. This value is used to determine the probability and impact of the risk based on respondent perceptions. Risk Level Classification: Based on the average calculation results, the risk level is classified into low, medium, high, or very high categories according to the risk assessment criteria. Cartesian Diagram: The probability and impact values of each risk factor are plotted on a Cartesian. Diagram to visualize the risk's location. This diagram is used to prioritize risk management on a project.

2.3. Research Instruments

Observation Guidelines: Observation sheets used to record K3 practices, work environment conditions, and compliance with SOPs. Interview Guidelines: A list of semi-structured questions compiled based on OHS indicators such as use of PPE, OHS training, and risk management.

Google Form Questionnaire Distribution: The questionnaire was distributed online by sharing a unique Google Form link with respondents. This link was distributed through various communication channels, including the Google Form link distributed via WhatsApp. To ensure the confidentiality and anonymity of respondents, the questionnaire was designed not to collect any personally identifiable information that could be traced back to respondents.

2.4. Research Indicators

Table 1. Research Indicators

Variabel	Indikator	Statement
Factor Man (X1)	Use of PPE (X1.1) Work fatigue (X1.2) Worker competency (X1.3)	1. Use of helmets, vests and safety shoes while working
		2. Schedule Rest fulfilled
		3. Attend K3 training Understand work procedures safe
Managerial Factors (X2)	Management commitment (X2.1) Occupational Health and Safety Supervision (X2.2) K3 Evaluation & Briefing (X2.3)	1. The existence of K3 policies and budgets
		2. Leadership commitment to occupational safety
		3. Presence of K3 officers in the field
Environmental Factors Work (X3)	Environmental conditions (X3.1) Weather and condition natures (X3.3)	1. The work area is clean and not dangerous
		2. Weather affects work
Factors Tools & Material (X4)	Condition of work equipment (X4.1) Material handling (X4.2) SOP for tool use (X4.3)	3. Danger signs are installed and clearly visible
		1. The tool is in good condition for use
		2. Materials are arranged neatly and do not instaeferfere with the work flow
Administrative Factors (X5)	SOP & K3 documentation (X5.1) Training & socialization (X5.2)	3. Workers understand and follow the SOP for heavy equipment or electrical equipment
		1. K3 SOP available
		2. Reporting and documentation of work accidents
Level Risk Work Accident (Y)	Injury Severity Level (Y.1) Disruption to work (Y.2)	3. Periodic K3 training work is done routinely
		1. Type and level severity on injury
		2. Disruption to thr smooth running of work

3. Results and Discussion

3.1. Analysis and Discussion

This study concluded that an inadequate work environment and inconsistent implementation of the OHS system were the main causes of the high potential for workplace accidents on this project. Therefore, improving the quality of the project's physical environmental management, regular safety training, and enforcing discipline in the use of PPE are strategic steps that must be taken. It is hoped that with improvements in these aspects, the project can run more safely, efficiently, and in accordance with applicable occupational safety and health standards in the construction industry.

Table 2. Analysis

Validity Test	r COUNT	R (0.361) N-2 = 28	Invormation
Factor Man (X1)	0.424	0.3610	Valid
X1.1	0.594	0.3610	Valid
X1.2	1.00	0.3610	Valid
X1.3			

Validity Test	r COUNT	R (0.361) N-2 = 28	Invormation
Managerial Factors (X2)			
X2.1	0.424	0.3610	Valid
X2.2	0.594	0.3610	Valid
X2.3	1.00	0.3610	Valid
Environmental Factors			
Work (X3)	0.630		
X3.1	0.404	0.3610	Valid
X3.2	1.00	0.3610	Valid
X3.3		0.3610	Valid
Factors Tools & Material (X4)	0.492		
X4.1	0.492	0.3610	Valid
X4.2	1.00	0.3610	Valid
X4.3		0.3610	Valid
Administrative Factors (X5)		0.3610	Valid
X5.1	1.00	0.3610	
X5.2	1.00		
Level Risk Work Accident (Y)	1.00	0.3610	Valid
Y.1	1.00	0.3610	Valid
Y.2			

Table 3. Reliabel Test

Validity Test	r COUNT	R (0.361) N-2 = 28	Invormation
Factor Man (X1)	0.746	0.6	Reliable
X1.1	0.746	0.6	Reliable
X1.2	0.746	0.6	Reliable
X1.3			
Managerial Factors (X2)	0.740	0.6	Reliable
X2.1	0.740	0.6	Reliable
X2.2	0.740	0.6	Reliable
X2.3		0.6	Reliable
Environmental Factors			
Work (X3)	0.762	0.6	Reliable
X3.1	0.762	0.6	Reliable
X3.2	0.762	0.6	Reliable
X3.3			
Factors Tools & Material (X4)	0.855	0.6	Reliable
X4.1	0.855	0.6	Reliable
X4.2			
X4.3			
Administrative Factors (X5)			
X5.1	0.1	0.6	Reliable
X5.2	0.1	0.6	Reliable

Validity Test	r COUNT	R (0.361) N-2 = 28	Invormation
Level Risk Work Accident (Y)	0.1	0.6	Reliable
Y.1	0.1	0.6	Reliable
Y.2			

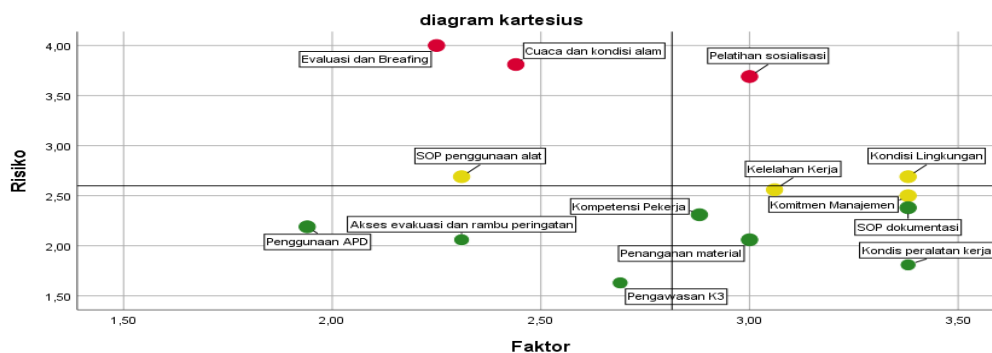
3.2. Coefficient Test

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,451 ^a	,203	,044	1,391

a. Predictors: (Constant), Administrative Factors, Environmental Factors, Equipment and Material Factors, Human Factors, Managerial Factors

Figur 1. Coefficient Test



Figur 2. Cartesian Diagram Test

Table 4. Reliabel Test

Indikator	pxl	
X1.1	Use of PPE	2.63
X1.2	Work fatigue	2.33
X1.3	Worker competency	1.77
X2.1	Management commitment	3.27
X2.2	Occupational Health and Safety Supervision	3.17
X2.3	K3 evaluation & briefing	3.13
X3.1	Environmental conditions	2.30
X3.2	Weather and natural conditions	2.13

	Indikator	pxl
X3.3	Evacuation access & warning signs	2.33
X4.1	Condition of work equipment	2.97
X4.2	Material handling	2.23
X4.3	SOP for tool use	2.23
X5.1	SOP & K3 documentation	2.77
X.2	Training & socialization	2.77
Y1.1	Severity of Injury	3.03
Y1.2	Disruption to Work	3.03

Based on research conducted on the Mayang Madu City Housing development project in Lamongan, it was found that Occupational Health and Safety (OHS) risks remain a significant challenge that requires serious management. This finding aligns with several relevant previous studies. For example, highlighted weak management and a lack of personal protective equipment (PPE) as key factors in the increased risk of workplace accidents. Identified that fatigue due to insufficient rest significantly contributes to workplace incidents, while emphasized the importance of training and regular use of PPE as effective forms of risk control.

4. Conclusion

1. The Occupational Health and Safety (K3) Risk Source Factors in the Mayang Madu City Housing Development Project are divided into five main categories:
 - a. Work Environment Factors are categorized as high, and statistically, they have a significant influence on workplace accidents. The physical project environment, such as confined work areas, slippery work surfaces, and extreme weather, are the main triggers for accident risk.
 - b. Managerial Factors: These are statistically insignificant risk factors for increasing workplace accidents. Indicators for this factor include: Weak management commitment to supporting the implementation of the OHS system.
 - c. Human Factors Although not statistically significant, human factors remain a potential risk contributor due to inconsistent safety practices. Some of the problems found are: Inconsistent use of PPE. Fatigue due to long working hours without good time management. Lack of worker competence in understanding and implementing safe work procedures. This shows that the influence of human factors must remain vigilant and be addressed systematically.
 - d. Equipment and Material Factors This factor has a moderate risk level. Equipment that is not regularly inspected and materials that are unsafely arranged can lead to workplace accidents, especially in structural work. While statistically insignificant, poor equipment and material management can increase secondary risks.
 - e. Administrative Factors: These are theoretically important but not statistically significant. Field findings indicate that OSH SOPs and accident documentation are available but not yet effectively implemented. OSH training is not conducted regularly and is merely a formality.

2. The Most Dominant Risk Factors.

Based on the results of the risk analysis using the probability and impact matrix (PxI), and supported by the mean test, it can be identified that the most dominant risk factor in influencing the increase in work accidents in the Mayang Madu City Housing development project is the Managerial Factor. However, overall there are five risk indicators that fall into the high risk category and should be a priority for control. The managerial factor is the most dominant factor because it has the highest risk score among all the indicators analyzed.

The only factor that is statistically significant to the risk of work accidents. The main problem in this factor is the weak commitment of project leaders to the implementation of work safety, characterized by, The absence of special K3 officers in the field. Minimal budget allocation for the procurement of PPE and safety training. The absence of periodic safety evaluations and briefings, so that workers do not have the latest information regarding potential work hazards.

5. Declarations

5.1. Author Contributions

Conceptualization, A.S. and I.M.; methodology, P.A.P.S.; software, A.S.; validation, A.S., I.M., and A.R.G.; formal analysis, A.S.; investigation, P.A.P.S.; resources, P.A.P.S.; data curation, A.S.; writing—original draft preparation, I.M.; writing—review and editing, A.R.G.; visualization, A.R.G.; supervision, P.A.P.S.; project administration, P.A.P.S. All authors have read and agreed to the published version of the manuscript.

5.2. Data Availability Statement

The data presented in this study are available on request from the corresponding author.:

5.3. Funding

Funding information is not available:

5.4. Acknowledgements

The authors would like to express their sincere appreciation to all parties who contributed to the completion of this study. The authors also acknowledge the support and facilities provided by the Civil Engineering Study Program, Universitas Islam Darul ‘Ulum (UNISDA) Lamongan, which greatly facilitated this research.:

5.5. Conflicts of Interest

The authors declare no conflict of interest.:

6. References

- [1] J. Teknologi, H. B. Prasetya, and H. H. Purba, “Tinjauan dan Analisis Risiko dalam Proyek Konstruksi Bangunan : Studi Literatur,” vol. 2, pp. 95–106, 2021, doi: 10.52330/jtm.v19i2.29.
- [2] M. N. Husni, M. Ardan, K. Ketenagakerjaan, and R. Indonesia, “S i l i t e k,” vol. 05, no. 01, pp. 223–231, 2025.
- [3] P. Studi *et al.*, “BERTINGKAT MILIK PEMERINTAH KOTA SURABAYA,” vol. 8, no. 2, pp. 103–112, 2020.
- [4] V. G. Kuhu, A. K. T. Dundu, and P. A. K. Pratisis, “Analisis Resiko Kesehatan Dan Keselamatan Kerja,” vol. 23, no. 91, 2025.
- [5] F. Teknik and U. Wiraraja, “Fakultas teknik universitas wiraraja sumenep - madura,” vol. 11, no. 1, pp. 27–38, 2023.
- [6] P. Perumahan and D. I. Sidoarjo, “PADA PROYEK PEMBANGUNAN PERUMAHAN DI SIDOARJO JATIM,” vol. 8, no. 1, pp. 35–44, 2020.
- [7] M. Heri and Q. Wilana, “Risiko Keselamatan dan Kesehatan Kerja Pada Pembangunan Gedung Bertingkat Delapan,” vol. 1, no. 1, pp. 43–48, 2021.